

Sławomir Stec

Ignacy Łukasiewicz Rzeszów University of Technology

The role of innovation in urban logistics on the example of Rzeszów

Rola innowacji w logistyce miejskiej na przykładzie Rzeszowa

Abstract. The article presents the role of innovation in city logistics, and above all the impact of modern logistics investments on the quality of life of residents. On the example of the proceedings of the local government of the city of Rzeszów, a brief description was made of activities related to innovations in urban logistics of various types: technological, organizational, structural, process and image-related. On the basis of a survey among the inhabitants of Rzeszów and the Rzeszów agglomeration, the impact of innovations in urban logistics was examined, among others on changing the behavior of society, lifestyle, preferences in movement, quality of life, as well as the identification of residents with the city. As a result of the research, it was found that the inhabitants perceive very well all already implemented and being implemented innovations in urban logistics. It was also recognized that modern investments contribute to improving the quality of life, lifestyle, air quality, health and safety. In particular, it can be said that the innovations made it possible, among others, to shorten travel time by public transport, smoothing traffic in congested areas, infrastructure integration of ecological forms of transport operating in the urban and suburban areas, connecting public transport with individual bicycle, pedestrian and car communication, improving the mobility of people with disabilities or people with reduced mobility, energy efficiency of urban transport by investing in transport with alternative propulsion systems, reducing the negative impact on the environment, including reducing noise and vibrations as well as greenhouse gas emissions, mainly CO₂.

Key words: urban logistics, innovation, transport projects, mobility

Synopsis. W artykule przedstawiono rolę innowacji w logistyce miejskiej, a przede wszystkim wpływ nowoczesnych inwestycji w obszarze logistyki na jakość życia mieszkańców. Na przykładzie postępowania samorządu miasta Rzeszowa, dokonano zwięzłej charakterystyki działań związanych z innowacjami w logistyce miejskiej o różnym charakterze: technologicznym, organizacyjnym, strukturalnym, procesowym oraz wizerunkowym. Na podstawie badań ankietowych wśród mieszkańców Rzeszowa i aglomeracji rzeszowskiej, zbadano m.in. wpływ innowacji w logistyce miejskiej na zmiany zachowań społeczeństwa, styl życia, preferencje w przemiesz-

czaniu się, jakość życia, a także utożsamianie się mieszkańców z miastem. W wyniku badań stwierdzono, że mieszkańcy bardzo dobrze postrzegają wszystkie wdrożone i wdrażane innowacje w logistyce miejskiej. Uznano również, że nowoczesne inwestycje przyczyniają się do poprawy jakości życia, stylu życia, jakości powietrza, zdrowia i bezpieczeństwa. W szczególności można stwierdzić, że innowacje umożliwiły m.in. skrócenie czasu podróży komunikacją miejską, upłynnienie ruchu na obszarach objętych kongestią, integrację infrastrukturalną funkcjonujących na obszarze miejskim i podmiejskim ekologicznych form transportu, powiązanie transportu publicznego z indywidualną komunikacją rowerową i pieszą oraz samochodową, poprawę mobilności osób z niepełnosprawnością lub osób z ograniczoną zdolnością ruchową, poprawę efektywności energetycznej transportu miejskiego przez inwestycje w transport o alternatywnych systemach napędowych, zmniejszenie negatywnego oddziaływania na środowisko, w tym redukcję hałasu i drgań oraz emisji gazów cieplarnianych, głównie CO₂.

Słowa kluczowe: logistyka miejska, innowacje, projekty transportowe, mobilność

Introduction

Urban logistics is a concept related to decision-making activities and activities aimed at improving the efficiency and reliability of media, cargo, cash and information flow control processes, and primarily related to the improvement of the movement of people in the city and adjacent suburban zones. Urban logistics is aimed at overcoming logistical difficulties, relieving the city from unnecessary transport, and also minimizing costs [Huk 2015]. In addition, as Tundys [2008] points out, urban logistics connects the flows of goods and services, controls them for supplying, cleaning and ensuring the internal functionality of cities, to reduce time losses, unnecessary transport, congestion, bottlenecks, and also tries to optimize the use of available resources. This concept, as urban logistics can be defined, is extremely important nowadays, when there is an intensive development of cities. In the European Union countries and Poland, the process of demographic urbanization has developed to such an extent that many cities are expanding in terms of topography and administration. The increase of areas of urban areas entails additional logistical problems in the form of inadequate technical infrastructure concerning, inter alia, transport and the entire management process [Zysińska 2019]. Hence, it is necessary to invest in urban logistics, which is usually of organizational and process-related character, in traditional and modern infrastructure, taking into account intelligent use of resources and participating management [Taniguchi et al. 2001]. However, the fact of investing in innovative solutions based on modern information technologies is of particular importance. On the one hand, innovations make it possible to significantly solve the logistic problems of large cities, on the other hand, investors, usually municipalities, benefit from funding from the European Union, which co-finances innovative solutions.

The above-mentioned processes of city expansion in the topographic and administrative sense are taking place more and more intensively in Poland. Over the last fifteen years, significantly increased their areas such cities as Zielona Góra (2015 by 219.98 km²), Rzeszów (by 72.88 km² in 2006–2019), Opole (by 52.44 km² in 2017), Koszalin (by 15.03 km² in 2009). All these cities faced the need to invest in broadly understood

urban logistics. In each of these centers examples of innovative solutions can be found. However, as the authorities of the city of Rzeszów have been implementing the concept of developing the strategy of the brand “Rzeszów – Capital of Innovation” for several years, the role of innovation in urban logistics will be presented on this example.

Goal and methodology of research

The main aim of the article was to present the role of innovation in urban logistics. On the example of the proceedings of the local government of the city of Rzeszów, a concise description of activities related to innovations in urban logistics of various types: technological, organizational, structural, process and image-related was made. The first four types of activities were presented on the basis of source materials presented in publications, local, regional and national media, scientific articles and internet portals, as well as on the basis of mass statistics data provided by the Central Statistical Office. On the other hand, image-building activities were developed and presented on the basis of a survey conducted among 250 people, residents of Rzeszów and the Rzeszów agglomeration, who have a close relationship with the city on a daily basis, e.g. through work, studies, education, shopping, business in offices, etc. Among others, the impact of innovations in urban logistics on changing the behavior of society, lifestyle, preferences in movement, quality of life, as well as the identification of residents with the city. It was these studies that were crucial in confirming the assumed result indicators, and above all, the assumed goals of the investments carried out in the field of urban logistics. The discussed topic is extremely extensive, therefore the focus was on the main concepts and projects that play the greatest role in urban logistics. This way of presenting the topic is helpful in spreading the knowledge and disseminating useful innovation.

The methods of processing and interpreting of facultative knowledge were applied using the descriptive method, the method of descriptive analysis and graphical presentation, as well as the study of the literature on the subject.

The role of city logistics and the implementation of innovations in city logistics in theoretical terms

The introductory chapter explains the concept of urban logistics. From the various definitions of this concept, one can read the role played by city logistics in the daily functioning of a local government unit. According to the definition of Witkowski and Kibajaniak [2011], “urban logistics focuses primarily on planning, coordinating and controlling processes related to the movement of people and goods (raw materials, semi-finished products, goods, waste, etc.) and information related to them in a way that optimizes costs, minimizes congestion and increases the quality of life of residents”. Therefore, it can be concluded that the role of urban logistics is to improve the quality of life of residents through investments and the maintenance of technical and social infrastructure by local governments. These activities contribute to the creation of conditions for efficient movement between individual city districts, both by own vehicle and by public transport (bus, tram, rail, ferry) [Jones 1981]. In addition, investments in technical infra-

structure are to contribute to the reliable supply of clean, healthy water for residents, and to ensure safe disposal of sewage. The task of city logistics is also to protect residents from floods using an effective sewage system. We should not forget about the efficient waste management or providing the society with access to energy and ICT infrastructure. The above-mentioned examples clearly show that the main role of urban logistics is to improve the living conditions of residents, and ultimately the quality of life. This quality of life is pointed out by many authors of publications on the role, function or goals of urban logistics. According to Borys and Rogal, objective and subjective quality of life can be distinguished. The objective quality of life is represented by indicators such as: monthly income, floor area, number of owned cars. In turn, subjective quality of life is an assessment of the degree of meeting the needs of society, e.g. satisfaction with income, the possibility of finding a good job, personal, health and sanitary safety, satisfaction with the apartment, the possibility of spending free time in an attractive way, efficient movement around the city, access for education, health protection, or convenient shopping, etc. [Borys and Rogal 2008].

However, it should be remembered that the quality of life is also influenced by the use of intensive technical and technological progress in almost every area of life. Also in city logistics. It is the application of all product and process innovations in city logistics that will contribute to the improvement of the quality of life in cities [Taniguchi et al. 2001].

An innovative city should be characterized by an infrastructure that improves the functionality of the city and contributes to the increase in the welfare of its inhabitants [Bryx 2013]. An important role in the process of improving the quality of the city's functioning is played by logistics management in its area, which should include passenger and goods transport, transit and export transport, securing and storing goods to meet the city's demand; city supplies; transport of waste and refuse from the city [Szymczak 2008]. Moreover, logistic innovation means the use of new information technologies, streamlining processes, increasing the level of employee involvement and ways of managing them and the inhabitants [Brdulak 2012]. "For the most anticipated solution to implement the idea urban logistics, which should be pursued, is considered to be supplementing the traffic management system with other systems and including them in a common network, which would create an integrated IT system supporting all areas of urban logistics" [Szymczak 2008].

The following chapters, and in particular the research of subjective opinions of the city society, will allow to verify the presented theoretical considerations on the impact of innovations in urban logistics on the quality of life of Rzeszów residents.

Innovations and their role in urban logistics on the example of Rzeszów

Rzeszów is the capital of the Podkarpackie Province, located in south-eastern Poland. It is a center with 196,821 inhabitants [Urząd Statystyczny w Rzeszowie nd.], and its area is 126.57 km² [Urząd Miasta Rzeszowa nd.a]. Since 2006, the city has incorporated 9 neighboring towns into its area, thus increasing by 72.88 km², from 53.69 km² in 2005, to 126.57 km² in 2019. From 1 January 2021, another village council – Pogwizdów Nowy

will be attached to the city, which will enlarge the city by another 2 km², and thus the number of inhabitants will increase by approx. 1,200. According to the data at the end of 2018, there are 267.6 km of municipal and poviata roads in Rzeszów with a significant number of vehicles, including 139,172 registered at the local communication department of the Rzeszów City Hall. The remaining infrastructure includes 634.8 km of water supply networks, 757.9 km of sewage network and 827.4 km of gas network. Public transport in the city is provided by the Public Transport Authority, which has created 62 communication lines, served by 220 buses.

The Wisłok river flows through the city, but it is not navigable. Sailing takes place only on an artificial retention reservoir named “Stopień Rzeszów”, built on the aforementioned river, and only in the recreational form, with the use of kayaks, pedal boats and small catamarans. Thus, it has no practical significance in logistics in terms of transport.

As innovations are considered to be modern solutions or significantly improved already existing products or processes, investments from the last 5 years were chosen to present the topic. One of the most image-enhancing innovations, and at the same time facilitating the movement of the city's inhabitants, are investments in public transport. Since 2006, Rzeszów was the first city in the country to focus on the innovative use of alternative power sources for public transport vehicles. At that time, buses powered by natural gas CNG were purchased. However, in 2018, the first 10 new low-floor electric vehicles were purchased. These are Solaris Urbino 12 buses. As part of the investment, slow and fast vehicle charging stations were purchased. Importantly, these buses were designed to serve city lines with line numbers 0A and 0B, characterized by a closed-loop system of 9.2 km each and 20 and 19 stops on a given line, respectively. This area is covered by plans to create a zero-emission zone in Rzeszów, which will be served only by electric and gas buses. Innovative on a national scale in these vehicles is the method of drive, using two electric motors, which are located at the wheel hubs on the right and left sides. Their power is 2×110 kW. In order to supply energy to these buses, investments were also made in vehicle charging stations. The bus is equipped with a plug-in connector for charging energy storages (batteries) (plug connector). This connector is used to charge the batteries at the bus depot. This is called slow loading. The maximum current that can flow through the connector is 125 A, and the charging time is about 180 minutes. The vehicle is also equipped with the so-called power receivers - railings placed on the bus roof. With their use, the energy supplied from the charging platform (OppCharge, the so-called inverted pantograph) is transferred to the energy storage (accumulators). This is called fast loading. The maximum current that can flow through the device is about 550 A. The charging time is about 10–15 minutes [Zarząd Transportu Miejskiego w Rzeszowie 2019].

The above investments contributed to the improvement of the energy efficiency of urban transport by investing in transport with alternative propulsion systems. In addition, the negative impact on the environment has decreased, including the reduction of noise and vibration as well as greenhouse gas emissions, mainly CO₂. This, in turn, has a significant impact on improving the quality of life in the city [Potyrański 2020].

Another new activity in the field of public transport is the construction and reconstruction of 156 bus bays and 163 stop complexes. An investment that may initially call into question the name of innovation. Well, the innovation in this case comes in three

areas. First of all, as part of the reconstruction of the stop bays, a modern type of “concave” curbs was used, and the platforms were supplemented with facilities for the visually impaired. Modern curbs enable buses to precisely approach the stops, and allow passengers to get in and out more comfortably, mainly to people with disabilities and the elderly, as the bus floor is at the platform level. In addition, the concavity of the curbs prevents damage to the vehicle tires in the event of approaching the platform edge too close [transinfo.pl 2017].

An innovation on a European scale is an investment in modern bus shelters, the so-called smart stops. A dozen or so bus shelters have a heating and air-conditioning system. During the summer heat, the air conditioning inside the shelter is turned on, and in the winter, when the temperature drops below 0°C, the heating installed under the roof of the shelter and in the seats is turned on. These stops are integrated with the photovoltaic installation. The energy generated by the PV system is used on an ongoing basis, in particular, air conditioning or heating, LED lighting, charging phones, heating windows and benches, and the surplus energy is stored in batteries [elektronikab2b.pl 2019]. These two innovations will contribute to improving the quality of life in the city, improving the comfort of waiting of passengers for a public transport vehicle, as well as reducing the negative environmental impact of greenhouse gas emissions, mainly CO₂.

In the field of public transport, another innovation has been implemented, which allows to make payments with a payment card or credit card directly at the ticket validator. So far considered innovative methods of purchasing tickets through a telephone application or the use of a city card, they have become common and are used throughout the country. The new contactless payment system in validators allows to pay for a bus ride with a payment card, telephone or watch, without the need to have a paper ticket or city card directly in the validator. The ticket is validated by placing the payment card against the card reader in a specially marked modern validator – the KFT (Known Fare Transaction) system. The next stage of implementing the above-mentioned innovation, which can undoubtedly be considered an innovation on a global scale, will be the implementation of the MTT (Mass Transit Transaction) system that allows the passenger to automatically select the cheapest ticket depending on the number of journeys made within 24 hours and the way of travel (for example transfers with or without a change, time tariff, check in – check out system – stop tariff). This solution is the first in Poland.

According to the Public Transport Authority in Rzeszów, the system is implemented thanks to such partners as: R&G Plus, VISA, eService, Solveo, FCS (Fare Calculator System) [Zarząd Transportu Miejskiego w Rzeszowie 2020].

In 2015, the construction of the Dynamic Passenger Information System (E-info) was started, which uses and processes data from all systems, and then generates information useful for travelers, allowing them to plan a trip and control its course. This information is available on 154 double-sided stop boards, where the actual departure time of buses for each line is displayed. Additionally, on the boards on the buses, travelers are informed, among others about the route and about the current and next stop. Also recently, information about the actual departures of other bus lines from the nearest stop has been updated. As part of this project, stationary and mobile ticket machines were purchased, which include allow to check the line layout as well as the current timetable.

The dedicated application presents information related to travel planning and control of its course [Magdoń 2016].

A significant innovation was also the implementation of the Rzeszów Intelligent Transport System, which consists of the following subsystems: Public Transport Management; Dynamic Passenger Information, Electronic City Transport Ticket, Area Traffic Control. All subsystems use dedicated radio communication to transmit data, ensuring not only communication with traffic and public transport management centers, but also with stops and buses running around Rzeszów. For the safety of passengers and drivers, both buses and stops as well as intersections are subject to video surveillance. The Public Transport Management System enables the management of the bus fleet through, among others, ongoing identification and location of vehicles, as well as control of the quality standards of the services provided and passenger service. At the same time, the system allows to keep statistics related to the number of passengers using public transport and supports the optimization of the layout of bus lines and their timetables. In turn, the Area Traffic Control System (SOSRD) supports traffic management depending on its intensity, through dynamic optimization of traffic lights, giving priority to public transport. SOSRD includes 60 traffic lights operating throughout the area of Rzeszów, and with 35 variable message boards, it enables drivers to be quickly informed about obstacles, changes in traffic organization, or recommended detours, as well as about the meteorological situation using the installed weather stations [Stankiewicz and Michalski 2018].

Another innovation in urban logistics, this time on a European scale, is being implemented in the area of parking space management. The parking space monitoring system in Rzeszów, as this is the official name of the project, will be analyzing the image from cameras monitoring the parking lots, and then process it, checking whether a given parking space is free or occupied. In places where it is impossible to place poles or lead nets, neural networks mounted in the parking lot surface have been used, which have the ability to detect vehicles. Information about vacancies will be provided to interactive information boards located in the paid parking zone and via a mobile application made available to residents. It will also be integrated with external applications enabling the payment of the parking fee. It is certainly a unique project in the field of smart city. Additionally, a data transmission system is being built, which will act as a relay between the Supervision Center and all elements of the RIST system. The fiber-optic network infrastructure is also being built using the existing LMDS and MESH networks, which in the future will enable connection with other municipal facilities. Thus, Rzeszów is the first city in Poland to use the MESH 5G technology. The innovative paid parking zone monitoring system brings many benefits to the city. Residents will find a parking space faster, which will reduce car traffic and thus exhaust emissions in the city center. The camera system will increase the level of security, and the collected data will allow to manage and optimize the functioning of the zone [transport-publiczny.pl 2019].

In the area of the city of Rzeszów and the Rzeszów agglomeration, an investment is being carried out under the name: Suburban Agglomeration Railway, which covers municipalities located within the railway lines running from Dębica to Przeworsk and from Kolbuszowa to Strzyżów. It can be concluded that this is an innovation on a macro-regional scale. The project includes the construction of a railway line to the Rzeszów Jasionka Airport, thanks to which the city center will be conveniently connected to the

airport. In addition, new passenger stops/platforms are being built along with accompanying infrastructure, new passages and station tracks are being built, platforms are being adjusted to TSI PRM requirements, the construction of a railway viaduct on DK 9, construction of interchange junctions and construction of park & ride car parks.

Thanks to the implementation of innovations, the driving time will be shortened, the frequency, communication and punctuality of the connections will be improved, the accessibility of rail transport in agglomeration traffic will increase, the mobility and accessibility of rail transport for the inhabitants of the Rzeszów agglomeration will be improved, and the quality of rail transport services of an agglomeration nature will be improved [Ministerstwo Funduszy i Polityki Regionalnej 2020].

Vehicle rental companies are increasingly used in city logistics. For several years now, Rzeszów has had an electric scooter, bicycle and scooter rental. These are fourth generation vehicles, you do not need base stations to rent them, you can rent them and return them anywhere [Urząd Miasta Rzeszowa nd.b]. Several companies also offer car rental under the so-called Car Sharing. Most of the cars offered for rent are electric. The above solutions offer residents the opportunity to move around the city on an individual basis, practically at any time of the day or night, for a reasonable fee. They contribute to the increase in mobility, reduction of the number of individual passenger cars, reduction of congestion on the road and, above all, reduction of air pollution, especially in the autumn and winter period, when smog is the most common. At the end of the presentation of examples of innovations in city logistics, it is worth paying attention to the implemented instant passenger journeys in the Bolt service. It is an example of modern taxis, the system of which is based on a mobile application for ordering and paying for rides. Payments are made in most cases without cash, and the passenger can track the location of the vehicle during the journey, the brand of the vehicle it will be traveling on, and the name of the driver. Importantly for passengers, fares for this service are approximately 50 to 70% lower than traveling by traditional taxi [Bolt.pl].

The role of innovation in city logistics and the quality of life in the opinion of the inhabitants

Each of the cited innovations had a greater or lesser impact on the quality and lifestyle of the inhabitants, changing behavior or preferences in moving around the city. In order to get to know the role of implemented innovations in city logistics, a study was conducted among 250 adult residents of Rzeszów and the Rzeszów agglomeration who have daily contact with the city. The 48% of women and 52% of men took part in the study.

Among the age groups, the most numerous participants were those aged 18–30 – 50.4%. Moreover, among the respondents there were 17.6% of people aged 31–40, 16.0% of people aged 41–50 and 12.8% of people aged 51–65. The smallest group of the surveyed inhabitants were the oldest people, as there were 3.2% of people over 65. In turn, in terms of professional status, the largest number of respondents was in the group of working people – 48%. Next, pupils and students responded – 39.6%, retirees and disability pensioners – 9.2%, and the smallest group of respondents were those who were not working, who constituted 3.2% of the respondents. The research was conducted in

November 2020, via online forms. The date of the study fell on the period of the coronavirus pandemic, therefore the survey indicated that the responses should eliminate situations related to limited mobility and the introduced restrictions in the field of public health protection.

First, the impact of innovations in urban logistics on the quality of life of city residents was examined (Figure 1).

According to the residents, the greatest impact on the quality of life in the city was the implementation of the Dynamic Passenger Information System, and above all the installation of variable message boards at stops and in buses, which indicate the actual timetable of vehicles. This innovation was indicated by as many as 94% of respondents. Subsequently, 84.4% of inhabitants emphasized that the fact that the air-conditioned and heated bus shelters in the city had a great impact on the quality of life. For every fourth inhabitant of the city, it was important to implement a payment system for traveling with an e-ticket or an electronic purse – a city card.

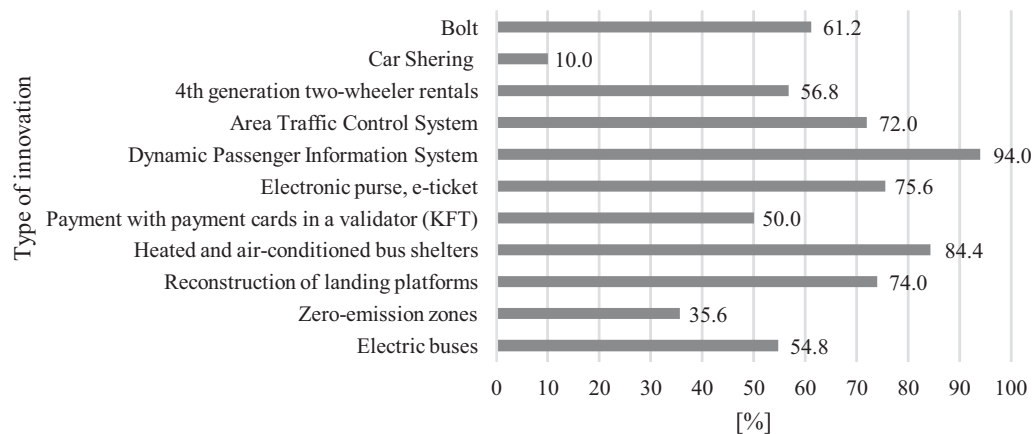


Figure 1. The impact of innovations in urban logistics on the quality of life of residents

Rysunek 1. Wpływ innowacji w logistyce miejskiej na jakość życia mieszkańców

Source: own research.

A similar number of people indicated an innovation having a large impact on the quality and comfort of life, an investment consisting in the reconstruction of stop platforms, enabling access to vehicles from the street level. In turn, more than half of the respondents considered that an important role in improving the quality of life is played by innovations in the form of modern Bolt taxis (61.2%), fourth generation two-wheeler rentals (56.8%) and the purchase of electric buses (54.8%). Every second respondent pointed to the significant importance of the possibility of paying for public transport with a payment card or a credit card. According to the respondents, the introduction of zero-emission zones or the possibility of renting a car in the Car Sharing system was of less importance.

The city authorities are not going to stop at these activities. The implementation and planning works are still underway as part of subsequent innovations. Therefore, the inhabitants were asked about the impact of the planned innovations in urban logistics on the quality of life (Figure 2). The research shows that the project of the Podkarpacka

Agglomeration Railway, which is at the stage of implementation, is the most enthusiastic, and the first trains will start on January 1, 2021. In this case, 74.4% of respondents considered this innovation to be very important, which will play a role in improving the quality of life in the city and agglomeration.

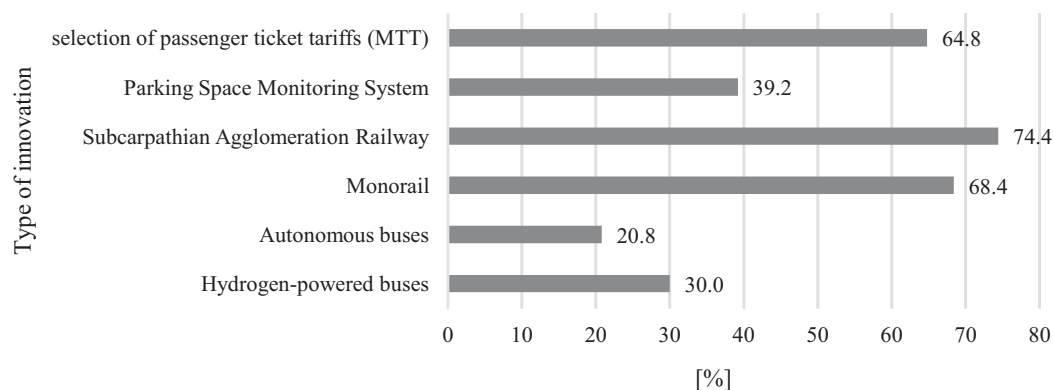


Figure 2. The impact of the innovations planned to be implemented in urban logistics on the quality of life of the inhabitants

Rysunek 2. Wpływ planowanych do wdrożenia innowacji w logistyce miejskiej na jakość życia mieszkańców

Source: own research.

Another innovation, indicated by over 68% of residents, is gaining considerable recognition. It is a monorail planned for construction, which is to cross and loop the main housing estates with the city center. Works on this project are advanced, and the biggest barrier so far has been the lack of appropriate legal provisions in the country recognizing the monorail as a public transport vehicle. Representatives of Chinese companies with extensive experience in implementing this type of investment were involved in the work on this investment [Urbanowicz 2020]. Another innovation, which is to improve the quality of life, is, according to over 64% of respondents, the implemented system that allows automatic selection of the fare to the passenger's needs. On the other hand, according to the inhabitants, the implemented Parking Space Monitoring System or the implementation of hydrogen-powered buses and autonomous buses are of less importance. The latter investment was postponed due to the prevailing coronavirus pandemic.

In a survey, the city inhabitants were asked about the role of all innovations in urban logistics (Figure 3). Most inhabitants (92.8%) indicated improvement in the quality of life. In turn, for 72.8% of respondents, innovations contribute to the improvement of life styles. Not much less people (76%) said that implementing new logistics solutions improves the city's image. Also, nearly every fourth inhabitant of the city believes that each innovation has an impact on improving air quality. The 66% of respondents believe that modern investments contribute to improving health. At this point, we can cite the opinions obtained during the hidden interview that the installation of automatic hand disinfection devices in all public transport buses was highly appreciated. In turn, more than half of the respondents indicated that innovations contribute to the increased identification of residents with the city, and according to over 46% of respondents,

innovations contribute to the improvement of air quality. The least role of innovation was seen by the respondents in contributing to the reduction of road congestion and noise reduction.

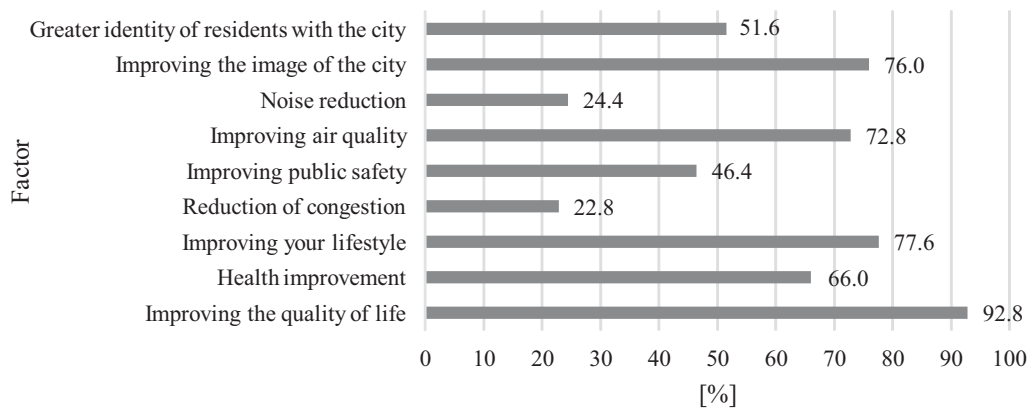


Figure 3. The role of innovation in urban logistics

Rysunek 3. Rola innowacji w logistyce miejskiej

Source: own research.

Summary and conclusions

For years, Rzeszów has been building its brand based on the slogan: “Rzeszów – the capital of innovation”. This translates into a number of activities of local authorities in the field of implementing innovations in urban logistics. As it results from the presented analyzes, many innovations on a global and European scale have been implemented in recent years. On the other hand, the vast majority of investments in the area of logistics are innovative on a national scale. Most of the innovations have tangible effects in terms of improving the quality and lifestyle in the city. And this can be owed among others to:

- shortening travel time by public transport, smoothing traffic in congested areas,
- infrastructure integration of ecological forms of transport operating in the urban and suburban area,
- linking public transport with individual bicycle, pedestrian and car communication,
- improving the mobility of people with disabilities or people with reduced mobility,
- improving the energy efficiency of urban transport by investing in transport with alternative propulsion systems,
- reducing the negative impact on the environment, including the reduction of noise and vibrations as well as greenhouse gas emissions, mainly CO₂.

The above-mentioned positive effects of implementing innovations were also noticed by residents who rightly noticed that modern investments contribute to the improvement of the quality of life, lifestyle, air quality, health and safety. They also believe that an important role of innovation is to improve the city’s image in country and abroad. It can therefore be concluded that the idea of the capital of innovation is also fully implemented in urban logistics, which plays an important role in the daily functioning of the urban unit.

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Correspondence address:

Sławomir Stec, PhD
(<https://orcid.org/0000-0002-5645-7507>)
Ignacy Łukasiewicz Rzeszów University of Technology
Faculty of Management
Department of Economics
12 Powstańców Warszawy Ave., 35-959 Rzeszów, Poland
e-mail: s.stec@prz.edu.pl